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REASONS SOME WELLS ARE DISAPPOINTMENTS

In the previous article of this series, we pointed out some lessons in test drilling and sampling learned from an actual case history. One of these is to take sand samples by methods that will get and preserve all the materials present in the stratum being sampled. Another is to recognize that there are local bad spots in almost all aquifers that must be avoided, if possible, in choosing well sites. These conclusions about sampling and about the importance of using every bit of available information in selecting well locations are also borne out by a municipal job in Kansas that came to our attention a little over two years ago. This case shows how the drilling contractor avoided making mistakes by deliberately setting out to take proper samples while doing his test drilling.

Case History in Kansas

The experience of Junction City, Kansas, is a good example of how accurate sampling of the formation and recognition of the need to locate wells where samples showed a minimum of silt and clay were combined to obtain two excellent wells in an area where past results were spotty. In 1950, the City needed two more wells to augment the yield from the four wells in its existing well field. A contract was let late that year to Jungmann Bros. of Topeka, Kansas, for test drilling and the construction of two new supply wells. The work was completed early in 1951.

The Junction City well field is on the flood plain of the Republican River. The wells are located on the south side of the river of the north edge of town. The wells are in the alluvial sand that has filled the vallley which the stream cut into beds of massive limestone in ages past. The alluvium in this vicinity ranges from about 50 to 80 feet in thickness, the greatest thickness being on the northeast side of the present river channel. The accompanying illustration shows the river valley at Junction City and the water-table contours as they were found in 1943.

The character of the alluvial material differs from one place to another. The proportions of clay, silt, sand, and gravel vary through a wide range, although the finer materials are commonly found in the upper part and coarser mixtures in the lower part of the aquifer. Considerable silt is found mixed with the upper sand down to depths as great as 40 feet in some places, and even the underlying coarser material contains some silt at certain locations. In the Junction City area, many white clay balls are found in the water-bearing formation in some places. The proportion of silt in the formation and the presence of these clay balls was largely ignored in previous well drilling here, but experience with some of the older wells showed that the formation is very tricky because of the effect of these materials on the yield. In fact, at least two wells drilled in the past failed completely because of the quantity of white clay balls in the sand and gravel at these particular sites.

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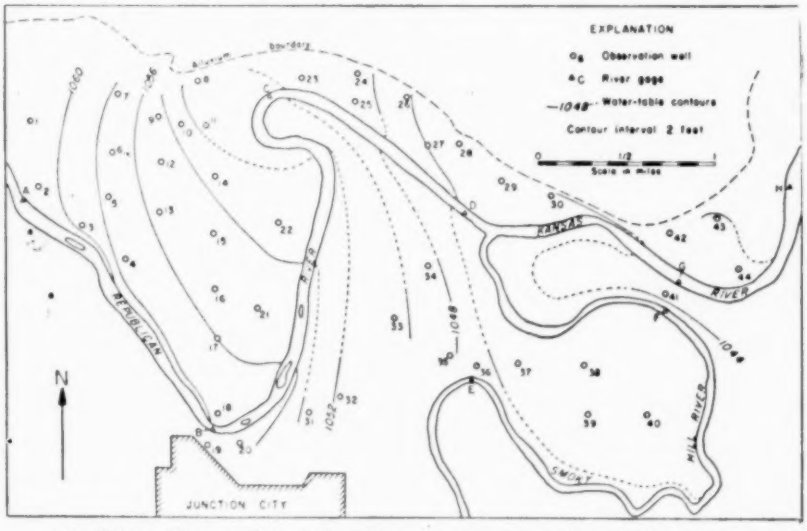


Republican River valley at Junction City, Kansas, and water-table contours in the alluvial sand. (From U. S. Army, U. S. G. S. and Kansas Geol. Survey data.)

REASONS WHY SOME WELLS ARE DISAPPOINTMENTS

(Continued from Page 1)

One of these was a 16-inch well drilled in 1939. A 16-foot well screen was used. When development was started, the well looked as though it would be a good one but the longer the surging was continued, the less water it produced. In addition the water was turbid, caused by the clay balls in the aquifer. This site had to be abandoned, and the screen was removed and re-set in another well about 150 feet away. The results at the second site were excellent. The well pumped 500 gpm with 6 feet drawdown, or at the rate of 83 gpm per foot of drawdown.

The second bad experience occurred in 1942 in constructing a 36-inch gravel-packed well with a concrete screen. The white mud balls were encountered at this site, also. When the test pumping was started, the well produced 650 g. p. m. but the water was quite turbid. It was thought that this would clear up with further pumping. However, after six hours the drawdown began to increase. At the end of the second day the yield had dropped off so much that the well was abandoned and another site 250 feet north was tried. Obviously, the concrete screen and casing could not be salvaged from the first hole but the second well was successful. After completion it was tested at 1025 gpm with 17 feet drawdown, or 61 gpm per foot of drawdown.

Jungmann Bros., Topeka, Kansas, lowering 12-inch Johnson Screen into well. Screen is suspended on sand line.

In 1948, this well was pumping 700 to 750 g.p.m. in almost continuous service. Later figures on its performance are not available. Meanwhile the only figures available on the two oldest wells showed their specific capacities to be about 25 g.p.m. per foot of drawdown in 1939 and somewhat less than this in 1950.

After a study of this experience with the two wells that had to be drilled twice and the history of performance of all four wells up to 1950, the drilling contractor decided to use every precaution in his test drilling for the two new wells he was to construct. He wanted to be sure to do the test drilling in such a way that any bad characteristics of the formation would be revealed. Thus he could discard poor sites and be more sure of the locations selected for the permanent wells.

In order to get samples that would accurately represent the water-bearing formation, the driller used the drive-core method of taking samples. Briefly this method involves driving a short core barrel, made of a piece of pipe, into the formation each time a sample is desired. The test hole may be drilled either by the cable tool or by the rotary method. The drive-core sampler is lowered to the bottom of the hole and driven into the formation below to obtain a sample. As the hole is deepened, samples are taken as often as desired. Samples taken in this way are not subject to any washing action and all the silt and clay that may be in the sand is retained. All other methods of sampling subject the sand to a certain amount of washing and thus they separate some of the silt and clay from the sand.

The driller used a cable tool drill on this job and he took drive-core samples of the water-bearing formation every two feet from the static water level to bedrock in each test hole. The samples were sent to the screen manufacturer for analysis and recommendations. The samples were also examined by the engineering firm, Wilson and Company of Salina, Kansas, retained as consulting engineers by the City.

Table I shows the screen slot openings indicated by the grading of the samples at the various depths in each test hole. In addition, it indicates the presence of silt and clay in those samples where there were any appreciable amounts present.

Test-Hole Analysis

These results were carefully studied to select the best of the three sites for the first new well. The coarsest sand was found in test hole A, and the finest sand in test hole B, as shown by the screen slot openings that could be used. Other things being equal, the coarsest sand is the most permeable and without the information on the relative amounts of silt in the sand samples, test hole A would have been selected at once as the best well site.

In this situation, however, it was felt that a clean sand formation was more important than the coarseness of the sand. Comparing the test holes from this point of view, shows that test hole B has

TABLE I
Summary of Tests of Sand Samples

Depth	Test Hole A		Test Hole B		Test Hole C	
	Selected screen openings	Silt content of sample	Selected screen openings	Silt content of sample	Selected screen openings	Silt content of sample
40' - 46'	—	silt and clay	—	silt and clay	25	fairly clean
46' - 50'	—	silt and clay	30	fairly clean	25	clean
50' - 54'	—	silt and clay	40	silty	40	silty
54' - 58'	70	silty	40	fairly clean	40	silty
58' - 62'	60	silty	40	clean	50	fairly clean
62' - 66'	60	silty	40	clean	50	fairly clean
66' - 70'	80	silty	25	clean	50	fairly clean
70' - 72'	Bottom - 70'		25	fairly clean	Bottom - 71'	
72' - 74'			40	silty		
	Static level 28'		Static level 27'		Static level 26'	

the thickest section of clean sand of any of the three. The screen manufacturer, therefore, recommended that the first well be constructed at site B, even though it meant using a well screen with considerably smaller slot openings than could be employed at sites A and C.

Test hole A was then completely eliminated for consideration as a well site beause of the amount of of silt and clay in the sand samples, and because the thickness of the water-bearing sand was several feet less than at the other sites. Test hole C was tentatively selected as the site for the second new well. The consulting engineer agreed with and approved these recommendations.

A 12-inch, natural-developed well was drilled at site B. Another set of samples was taken which checked the test hole data. A Johnson well screen 20 feet long was used in this well. The driller bottomed the well at 71 feet which put the top of the screen at 51 feet. With the static level at 27 feet, this provided about 24 feet of available drawdown. After normal development by surging, bailing, and light backwashing, a test pump was put in. The well was test pumped for 12 hours at 1000 g.p.m. with 16 feet drawdown, or a specific capacity of 63 g.p.m. per foot of drawdown. This result proved the soundness of selecting this location for one of the new wells.

Lack of sufficient power prevented pumping at the maximum capacity of the well, but the test pump did put out 1345 g.p.m. for a short period. The water was sand-free during the entire pumping test.

The second 12-inch well was then drilled at site C. The well screen was made 18 feet long for this well because the test hole showed the bedrock to be about 2 feet higher than at the other site. This well was completed in the same way as the first one. When test pumped for 12 hours it delivered 100 g.p.m. with 17 feet drawdown, or 59 g.p.m. per foot of drawdown. At no time during the pumping test was there any show of sand.

This job is a good example of how accurate samples from test holes permitted correct selection of well sites to be developed for two new wells in a well field where past experience had indicated that in the absence of good sampling it was a hit or miss proposition.

If the driller had done a lot of mixing by drilling in the hole with regular tools or had used a bailer carelessly in taking the samples, he would have washed out much of the silt that is actually present in this particular formation. Likely as not, the samples from test hole A might then have indicated a fairly clean formation and site A would have been selected for the first well. The results certainly would have been disappointing.

The main point is this—every driller who develops better methods of test drilling and sampling of water-bearing formations gives better service and greater satisfaction to his customers. This is the soundest kind of sales promotion.

Effect of Limited Aquifer

After having discussed in detail two case histories that demonstrate the difficulties that may result from poor sampling, let us turn to another cause of well disappointments that is quite common. Without realizing the true situation, a well is often completed in an aquifer of limited extent. Such an aquifer is a body of water-bearing sand which is only a local deposit that pinches out in two or more directions within a short distance of the well. The effect is that the groundwater reservoir is too small to support the well under conditions of more or less constant pumpage. As the result, the pumping level continues to drop when the well is used and may never become stable unless the pumping rate is reduced to a fraction of the possible yield of the same well drilled in an extensive aquifer. If the aquifer is entirely bounded by clay on all sides, the water may be completely pumped out of the sand body and the well will go completely dry.

These local deposits of water-filled sand and gravel, are fairly common throughout the large portion of the United States that was once covered by the great glaciers which left the deposits of boulders, gravel, sand, silt, clay, and mixtures of these materials that we call glacial drift. Until recently, about the only way to find out if a body of water-bearing sand in a given locality was simply a pocket, or aquifer of limited extent, was to drill enough test holes in the area to permit mapping the boundaries of the aquifer in various directions. Enough test drilling to accomplish this is seldom done because, in many instances, the well owner cannot see clearly that the information is worth as much to him as the test drilling might cost. Without this knowledge, the owner, in contracting for a permanent water well, has to take the chance that the water-bearing formation in which the well is to be completed is a

(Continued on Page 4)

Test pumping well B for Junction City; 1000 gpm at 16-ft. drawdown.

REASONS WHY SOME WELLS ARE DISAPPOINTMENTS

(Continued from Page 3)

ground-water reservoir large enough to provide the quantity of water desired year in and year out.

In the last two or three years, we have learned how to get a general picture of the extent of an aquifer by analyzing information from carefully conducted pumping tests. The way the drawdown in the pumped well and in one or more observation wells changes with time will show that the aquifer extends to considerable distances or that it is hemmed in by impervious boundaries fairly close to the pumped well.

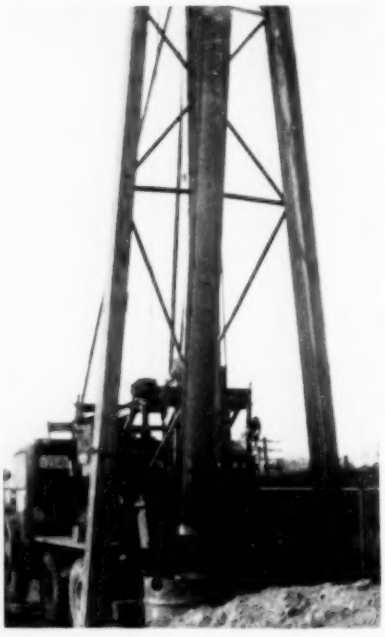
These pumping tests often can be made on 4-inch to 8-inch test wells so that the cost of such a test is reasonable where the proposed permanent well is of sufficient importance. The use of the pumping test as suggested here does not eliminate the necessity for drilling test holes but it does help to indicate where additional test holes ought to be drilled to get the maximum information about the aquifer. In this way, the owner gets more for the money that he spends for test drilling.

For example, the approximate distance to at least one of the boundaries of a limited aquifer can be calculated and, in some cases, the direction toward a boundary can be determined. With such information as a guide, test holes can be located in the direction of the main body of the aquifer to explore it more in detail if required.

The procedure and the basis for analysis of pumping-test data to determine certain things about an aquifer involve the application of some mathematics and the theory of ground-water hydraulics. It is not our purpose here to go into these details. However, we do want to show some results of pumping tests and point out what they indicate as to the character of the aquifer that is tapped by the pumped well.

Irrigation Well

A typical case of a well in an aquifer of limited extent is an irrigation well located near Watertown, Minnesota. The farmer wanted an irrigation well that would yield 500 to 1000 g.p.m. for supplementary irrigation of alfalfa. He wanted to supplement the normal rainfall at those times when the rain did not come at the right time to be of greatest benefit to the alfalfa crop.



A 12-inch Johnson Screen, 15 feet long, being set by C. E. Snider of Woodbridge, Ontario, in a well for International Waxes at Agincourt, Ontario. The well tested 800 Imperial Gallons (960 U. S.) per minute at 36-ft. drawdown.

He employed one of the best drilling contractors in the area to do the work. He had the driller put down a test hole at the spot that was the most convenient location for the irrigation well. Logs of other farm wells in this vicinity were not too helpful because only one of them had been drilled entirely through the glacial drift. The test hole was drilled and it penetrated 186 feet of glacial material, of which only one 5-foot stratum, between 115 feet and 120 feet, was water-bearing sand. The static level was 30 feet below ground surface. This stratum was excellent material for a well for domestic and farmyard use but entirely inadequate for an irrigation well.

A second test hole was then drilled about 300 feet southeast of the first one. Some 12 feet of coarse sand containing quite a lot of silt was found at 102 feet to 114 feet with the same static level as in the first test hole. Analysis of the sand samples, however, showed that the material was not clean enough to have a high yielding ability.

A third test hole was then drilled a quarter-mile to the west. This site was chosen for a test because one or two farm wells about two miles to the west had tapped clean sand and gravel when they were drilled. The glacial drift at this site was found to be 180 feet thick. The lower 70 feet of it consisted of alternate layers of sand and lenses of clay. In all, there was probably 30 feet of water-bearing sand but the strata were thin and interspersed with so many layers of clay that it was questionable whether a well of adequate yield could be constructed at this location.

Fourth Test Hole

The farmer then decided to try one more test hole before giving up. He chose a point about 1500 feet south of the first test hole for the fourth one. This happened to be the highest point of this section of the farm which made it desirable as a site for an irrigation well. Fortunately site No. 4 was a good choice and the farmer was most happy when the driller submitted the following log showing 71 feet of clean sand and gravel formation.

Test Hole No. 4

0′ - 70′	Clay
70′ - 75′	Dirty sand
75′ - 95′	Clay
95′ - 109′	Dirty sand, clay streaks
109′ - 123′	Fairly clean sand
123′ - 194′	Clean sand and gravel
194′ - 205′	Clay

Static level - 37 feet

Samples of the clean water-bearing sand were submitted to the laboratory for analysis. A 30-foot screen was recommended. The sand tests showed that the top 6 feet of the screen should be No. 60 slot and the remaining 24 feet should be No. 80 slot.

The farmer ordered a 12-inch well constructed, 194 feet deep, with the well screen set between 164 feet and 194 feet. The well was drilled with a rotary drilling machine. A cable tool machine was brought in to set the screen and to

(Continued on Page 11)

A. P. I. STANDARDS FOR DRILLING-TOOL JOINTS

Like all craftsmen, well drillers are dependent upon their tools for the success of their business. To a large extent, the quality of these tools determines the progress of their work which, in turn, is the first measure of success in well drilling.

No single part of drilling tools is of greater importance than the joints. Trouble at the joints has been a major headache in the business at all times—a cause of fishing jobs, lost holes, and other expense, to say nothing of confusion in the past from lack of accepted standards.

Many years ago, the American Petroleum Institute determined to make a study of cable drilling tools —with special attention being given to the tool joints—in an attempt to solve many of the troubles through a scientific selection of the best possible specifications for the joints. Two important steps were taken toward eliminating confusion and misfits in drilling tool joints as results of the work of the committees of the Institute some twenty-five years ago. One of the committees adopted, on October 24, 1924, a standard specification for cable drilling tools; another committee adopted a similar specification for rotary drilling equipment on December 8, 1926.

The First Standards

The first of these standards, covering cable tool joints, was based to some extent, on what were commonly known as the "Eastern Specifications," or the I & H (Ireland and Hughes) standards. As a preliminary step, the committee issued the specifications and ordered a master gage in the 3¾ inch size, and with this master gage a subcommittee checked the standard gages of various tool manufacturers. They found considerable variation in the different plants. It was then decided that Pratt and Whitney should be commissioned to manufacture two grand master sets of gages and three regional reference master (ground and hardened) sets of gages for each size of tool joint. One set of each of the regional master gages was to be deposited, as the property of the American Petroleum Institute, with three depositories in the Eastern, Mid-Continent, and Pacific Coast areas. These regional master sets then became available for checking the gages owned and used by various manufacturers of tool joints in each of these areas. The grand master gages were deposited with the National Bureau of Standards in Washington, D. C., to be used only in case of a dispute.

Coverage of Specifications

The specifications issued by the American Petroleum Institute on cable drilling tools applies to cable drilling tool joints, rope socket necks, and diameters of jars. It is dimensional only, and does not cover kinds of materials, heat treatment, nor methods of manufacture. It covers workmanship and finish in a general way only, requiring that machined surfaces shall be finished in a good and workmanlike manner, free from burrs, and rough edges.

Tools with A.P.I. standard joints, produced by a licensed manufacturer are marked with both the size of the joint and the A.P.I. monogram.

3¾-7 API

Licensing Manufacturers

The Institute will license properly qualified manufacturers to produce A.P.I. tool joints and to label them with the A.P.I. monogram. This mark is the manufacturer's certification that the joints meet the requirments of the specifications. To receive this license a manufacturer must submit an application to the American Petroleum Institute giving pertinent information regarding the company, its equipment and qualifications. With this there is also submitted an application for permission to use the A.P.I. monogram. The license, when granted, is subject to cancellation for any of the following reasons:

1. Using the monogram on material that does not meet the specification.
2. Failure to report on use of monogram.
3. Failure to use the monogram on material meeting the specification.
4. Failure to follow marking stipulations.
5. Improper use of the letters "API".
6. Failure to test master gages, or to report on condition of master gages.
7. Using the monogram on material controlled by gages which are beyond approved tolerances.
8. Failure to repair gages known to be beyond approved tolerances.

Basic Thread Form

Figure 1 shows the details and the basic form of thread for 7-thread and 8-thread joints. The following explanation will further clarify the illustration:

The angle between the sides of the thread is 60 degrees. The crest of the threads is flattened parallel to the taper; and the root is flattened parallel to the axis. Standard

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Plenty of bit dressing to do on this 8" well near Peabody, Massachusetts, by Eastern Drilling Company, Woburn, Massachusetts.

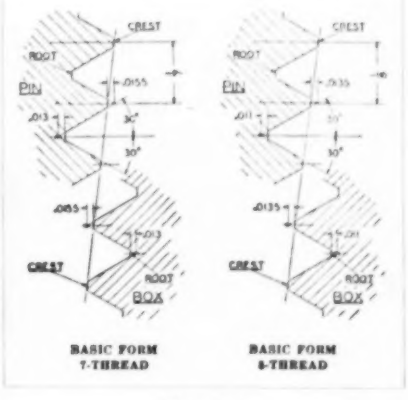

Figure 1

DRILLING-TOOL JOINTS

(Continued from Page 5)

pitch of threads is 7 per inch on joints 1⅝ x 2⅝ and larger, and 8 per inch on 1½ x 2¼ and smaller. The taper of the joint is 1:4 or 3 inches per foot.

The dimensions for the standard sizes of joints are shown in Table I. The diagram at the bottom shows where the dimensions are measured.

Table II and Table III show the dimensions of standard rope socket necks and of drilling and fishing jars.

Use of Joint Sizes

Table IV gives three lists of joint sizes used by various drillers for the drill or hole sizes shown. It will be noted that, although there is variation in the selections, the range is small. Many drillers combine sizes so as to reduce the required number of tools, making use of substitute joints to permit assembling of different sizes of joints in the same string of tools. The use of small joint sizes on relatively large tools generally goes with the use of the lighter weight of bits for a given size. As an example, one manufacturer's listing of standard-weight, 10-inch bits shows a difference in weight of nearly 100 percent between the lightest and the heaviest. Likewise, differences in drilling conditions will lead one driller to adopt, as his standard, joint sizes which provide as much hole clearance as possible, whereas another driller may prefer to adopt the maximum joint size which he can use effectively with a given size of bit.

Requirements of Manufacturers

There are very definite and rather exacting requirements to be

TABLE I

DIMENSIONS OF CABLE DRILLING TOOL JOINTS

All Dimensions in Inches

1	2	3	4	5	6	7		8	9	10	11	12
								Length of Collars				
									For Drilling and Fishing Jars			
Nominal Size of Taper Joint	Number Threads per Inch	Length of Taper Pin	Size of Wrench Square	Diameter of Pin Collar	Diameter of Box Collar			For Stems	Reg. Collars	Long Collars	For Drilling Bits	For Fishing Tools and Subs
A x B	C	E	F	G§	H			J and K (Minimum)				
1x1½	8	2	1½	2	2 1/16	Pin	J	2⅛	2½	5	5	2⅛
						Box	K	3⅛	3½	5	.....	3⅛
1⅛x1¾	8	2½	1¾	2⅛	2⅝	Pin	J	3	3	5½	5½	3
						Box	K	5	5	6	.....	5
1½x2¼	8	3	2¼	3⅛	3⅛	Pin	J	3½	3½	6	6	3½
						Box	K	6	6	7	.....	6
1⅝x2⅝	7	3½	2¾	3⅝	3¾	Pin	J	4	4	7	7	4
						Box	K	7	6	8	.....	6
2x3	7	4	3¼	4¼	4⅝	Pin	J	5	4½	7½	7½	4½
						Box	K	9	7	9	.....	7
2¼x3¼	7	4	3½	4½	4⅝	Pin	J	5½	4½	8	8	4½
						Box	K	9½	7	9½	.....	7
2½x3½	7	4¼	4	5	5¼	Pin	J	6	5	8½	8½	5
						Box	K	10	7	10	.....	7
2¾x3¾	7	4½	†4	5¼	5½	Pin	J	6	5	8½	8½	5
						Box	K	11	8	11	.....	8
3x4	7	4¾	4½	6	6¼	Pin	J	6½	5½	9	9	5½
						Box	K	11	8	11	.....	8
3¼x4¼	7	5	5	6¼	6½	Pin	J	7	6	10	10	6
						Box	K	12	9	12	.....	9
3½x4½	7	5½	5	6½	6⅝	Pin	J	7	6	10	10	6
						Box	K	12	9	12	.....	9
4x5	7	5½	*5½	7	7⅜	Pin	J	7½	6½	11	11	6½
						Box	K	12	10	12	.....	10
4x5½	7	6½	5½	7½	7⅞	Pin	J	7½	6½	11	11	6½
						Box	K	12	10	12	.....	10
4¼x6	7	7	6	8¼	8⅝	Pin	J	8	7	12	12	7
						Box	K	13	10	13	.....	10

§Optional pin collars with diameter H (Col. 6), obtainable on special order.

†Optional wrench square of 4¼ obtainable on order on 2¾x3¾ joints.

*Optional wrench square of 5 obtainable on order on 4x5 joints.

Maximum allowable tolerance on dimension E shall be plus ⅛ minus 0.

Maximum allowable tolerance on dimension F shall be plus 1/16 minus 1/16.

Maximum allowable tolerance on dimensions G and H shall be plus 1/64 minus 1/64.

Minimum allowable length for dimension L shall be E plus ¾.

The permissible range of lengths for jar collars shall be from the minimum of REGULAR COLLARS to the maximum of LONG COLLARS.

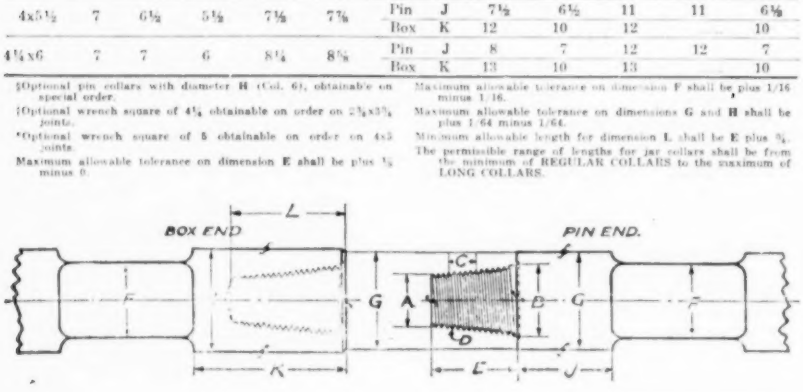

TABLE II

DIMENSIONS OF API STANDARD ROPE SOCKET NECKS

All Dimensions in Inches

1	2	3
API Taper Joint	For Manila Cable Dia. Rope Socket Neck A	For Wire Cable Dia. Rope Socket Neck B
1x1½	*	1¼
1⅛x1¾	*	1½
1½x2¼	*	1½
1⅝x2⅝	2¾	2½
2x3	3¼	2¾
2¼x3¼	3½	3¼
2½x3½	3½	3½
2⅝x3⅝	3½	3½
3x4	4	4
3¼x4¼	4½	4½
3½x4½	4½	4½
4x5	4½	4½
4x5½	5½	5½
4¼x6	5½	5½

*Manila cable not practical in these small sizes.

TABLE III

API STANDARD DIAMETER OF JARS OVER REINS AND RECOMMENDED STANDARD LENGTHS OF STROKES

All Dimensions in Inches

1	2	3	4	5	6
Nominal Size of Taper Joint	*Diameter Over Reins.	Short Stroke For Use Next To Bit or Reamer	Short Stroke for Regular Drilling	General Utility for Cleaning Out, Deepening, Etc.	FISHING JARS
1 x1½—8	2⅛			10	24
1⅛x1¾—8	2½			10	24
1½x2¼—8	3¼			10	24
1⅝x2⅝—7	3⅝		4½	10	24 30
2 x3 —7	4⅜	3½	4½	10	24 30 36
2¼x3¼—7	4¾	3½	4½	10	30 36
2½x3½—7	5¼	3½	4½	10	30 36
2¾x3¾—7	5½	3½	4½	10	36 48 60
3 x4 —7	6¼	3½	4½	10	36 48 60
3¼x4¼—7	6½	3½	4½	10	36 48 60
3½x4½—7	6½	3½	4½	10	36 48 60
4 x5 —7	7	3½	5	10	36 48 60
4 x5½—7	7½	3½	5	10	36 48 60
4¼x6 —7	8¼	3½	5	10	36 48 60

*The committee has specified no tolerance for diameter over reins; however, it is recommended that insofar as present (Jan., 1929) manufacturing equipment permits, manufacturers should not make diameter over reins larger than box diameter specified in Table I.

met by manufacturers who wish to produce API standard drilling tool joints carrying the API monogram. Among these requirements are the following:

"Anyone desiring to produce API standard cable drilling tool joints shall provide himself with reference master gages which have been manufactured and certified in accordance with stipulations in the API specifications."

"When a manufacturer is prepared and ready to use the standard cable drilling tool reference master gages, he shall apply to the American Petroleum Institute for a certificate of authority to use the official API monogram on the product. Separate applications are required for each size of tool joint for which final specifications are given . . ."

Licensed manufacturers must meet the requirements regarding maintenance of their reference gages. In part, these are as follows:

"The maintenance of API reference master cable tool joint gages within the limits specified is the responsibility of the licensee. API reference master gages should be checked by the licensee at intervals sufficiently frequent to insure adherence to mating standoffs for used reference master gages, as stipulated herein. Mandatory rechecks every three years are specified herein for used API reference master mating tool joint gages, but it is recommended that such gages receiving ordinary usage be re-checked annually by an API custodian for both mating and interchange standoffs. All testing and retesting stipulations on gages given herein are mandatory as applied to all manufacturers or vendors of equipment who have been granted the right to use the API monogram under this specification. In the case of non-vendors of equipment (those possessing API reference master cable tool joint gages for use in their own shops or for checking purposes), it is recommended that their gages be retested by an API custodian as provided herein. Gages owned by a non-vendor licensee shall not be considered as evidence of accuracy in case of a dispute with a vendor licensee whose gages have been tested as stipulated herein and found to be within the limits specified, unless such non-vendor's gages have been similarly tested and found to be within the stipulated limits . . ."

TABLE IV.

I.D. of Casing	Joint Selection A	Joint Selection B	Joint Selection C
3"	1⅛x1¾	1⅛x1¾	1⅛x1¾
3½"	1⅛x1¾	1⅛x1¾	1⅝x2*
4"	1½x2¼	1⅝x2*	1½x2¼
5"	1⅝x2⅝	2x3	1⅝x2⅝
6"	2x3	2¼x3¼	2¼x3¼
8"	2¼x3¼	2½x3½	3x4
10"	3¼x4¼	3½x4½	4x5
12"	4¼x6	4x5½	4x5½

* not API standard size.

Gaging Practice

Figure shows the procedure to be used in gaging the parts of a tool joint, using the ring gage for checking the pin and the plug gage for checking the box. It will be noticed that the ring gage is screwed onto the pin of the tool and the plug gage is screwed into the tool box. The gages actually used to check the tool joint are not the reference gages but are accurate copies, called "working gages". Reference gages are used solely to check the accuracy of working gages. The correctness of the joint is determined by the "standoff." In checking the pin with the ring gage, the finger gage shown in Figure 2 is used to determine the minimum standoff of ⅝-inch (0.625") between the pin collar and the ring gage. A feeler gage is used with the finger gage

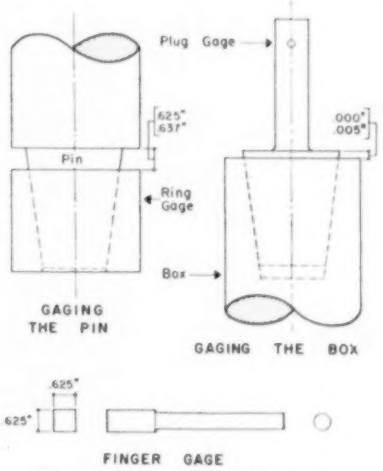

Figure 2. Gaging of Tool Joint.

to make sure that the maximum standoff of 0.637" is not exceeded. This allows a standoff tolerance of .012". On the box joint, the standoff must be between zero and .005".

Other Details Covered

The A.P.I. specifications go further than the gages used. They also give recommendations for actual shop practice for turning cable drilling tool joints. Figures 3, 4 and 5 show some of the illustrated shop suggestions that the standards cover.

(Continued on Page 18)

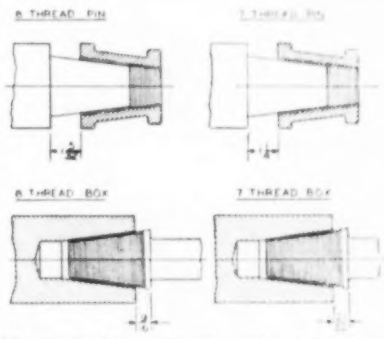

Figure 3. Pin and Box Turning Sizes Before Threading.

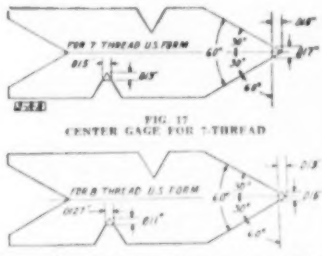

Figure 4. Center Gages for Thread Forms and for Setting Threading Tools.

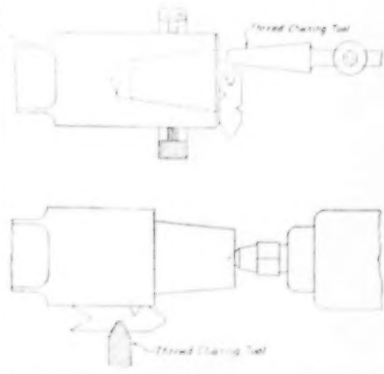

Figure 5. Using Center Gages to Set Threading Tools for Box and Pin.

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TOM'S COLUMN

Dear Fellows:

Well, here's a couple more months gone by like a shot out of a gun. Seems time goes faster, an' faster ev'ry year—or I'm gettin' too slow to keep up. Yesterday I got my first look at them cute twins that Swig's wife surprised him with a while back, an' I felt kinda puffed up when he says to me, "Tom, we're a-callin' that boy over there after you. Yep! I reckon he'll be Tom, th' driller, number two."

"Now that's doggoned nice o' you," says I.

"Well," says Swig, with a grin an' a wink at his wife, "We figgered it fit O.K. 'cause ev'ry time he opens his mouth he sticks his foot into it."

Then they all give me a good laughin' at, an' all I could do was laugh with 'em. But I reckon I'll go right ahead an' open up my mouth again anyway, even if I do stick my foot into it.

I was readin' th' article in th' Journal 'bout wells that are a disappointment an' how you can get misled even with samples an' a log if you don't have th' things accurate. It took me back to a job that I jest wrote th' finish to this year an' that was started away back about 1940 when I got a call from a local engineer to ride up with him to look over a job in a town about a hundred miles north o' here. It was a small town—some 500 people—an' they wanted to add to their water system so they could be in better shape fer fire protection more than anythin' else. Th' wells they had was two 6-inchers put down to about 200 foot deep. They was set 50 feet apart an' were finished in a sand an' gravel formation without any screen. Jest open bottom. Th' water rose to about four foot o' th' top an' they pumped 'em both with a header connected to a ol' fashioned triplex pump that was slowed down so they only pulled th' water down to around 16 foot from th' surface. They was gettin' about 60 gallons a minute from both wells together, which got 'em by O.K. but didn't leave anythin' to fall back on.

When we got there th' engineer rounded up th' mayor, th' fellow who took care of th' pump an' fire rig, an' a couple of th' councilmen. He asked me to look over th' layout an' see where it would be easiest to put in a new well with a new pump with th' least possible building cost. Well, that wasn't hard

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to answer. Their old wells was right under th' watertank at th' north end of th' building. Th' building was somethin' like 60 x 100 an' by goin' to th' far end where they kept th' fire truck you could put on jest a little jog an' locate a well over a hundred feet from either of th' other wells.

After talkin' things o v e r amongst ourselves, they told th' engineer to lay it out to tie into th' existing setup, an' to make a set o' specifications fer th' new well an' pump.

The well was to be a 10-inch drilled through th' same sand an' gravel formation an' to be finished with a screen fitted to th' samples an' set by pullin' back th' casin'.

We got th' job when it was let an' we started drillin' th' next week. Ev'rything went swell all th' way through. When we took our samples in th' water formation they was purty dirty an' there was a lot o' slimey clay mixed in with th' sand an' gravel. We thought we'd help things along by sendin' in th' samples as clean as we could; so we washed out th' worst o' th' clay—which was a mistake because while it was a good sample o' th' sand an' gravel, it didn't show th' clay that was mixed with it.

We hit th' top o' th' formation at 182-foot. There was 3-foot o' real muddy stuff on top, then from 185 to 195 it ran fairly coarse sand with a quite a lot o' fat clay mixed with it. From 195 to 210 it was purty nice gravel but had a lot o' this clay with it. After th' samples was analyzed, th' screen they recommended was a Johnson Everdur 20 foot long to be set between 190 and 210 with th' top 8 foot No. 30 slot and th' bottom 12 foot No. 80 slot.

We lowered th' screen in, pulled back th' casin', swedged th' packer, an' then bailed it out. Very little sand came into th' screen. So then we ran a surge plunger—valve type. When we went back in with th' bailer we took out a lot o' sand an' mud. This looked good; so we went after it some more with th' surge plunger an' got some more stuff out, but not as much as th' first time. So then we decided it was time to run th' test pump.

Boy, if you wanted to see a disappointed bunch o' men you should of seen us when we checked that test. She drew down 57 foot (to 60 foot level) and only pumped 120 g.p.m.—only about 2 g.p.m. per foot o' drawdown. With this good sand an' gravel an' th' good screen opening, we had figgered on gettin' at least 25 g.p.m. fer each foot o' drawdown.

Well we decided to try developin' it with air lift because we thought maybe th' surge plunger was packing th' clay in tight. We used 6-inch pipe an' 1-inch air-line. Our compressor give us 250 cu. ft. o' air per minute with pressure up to 125 lbs. We started pumpin', surgin', backwashing, an' blowin' heads. Th' well cleared up in a hurry but we could tell by th' gages that th' drawdown stayed just about as bad.

Then we was kind o' stumped. One o' th' boys remembered readin' about a well somethin' like this some years ago an' suggested maybe this one might clean up with acid, too. First thing we did was take a sample o' th' clay we had in th' slush pit an' tried some acid on it. Sure enough th' acid seemed to cut th' fat clay an' make it more like regular mud that would wash away easier. We got into a huddle with th' engineer an' th' mayor an' got their O.K. to try treatin' th' well. We got a truckload o' muriatic acid in carboys an' fed th' acid into th' well through th' 1-inch black airline, startin' at th' bottom an' gradually pullin' back until we had put in 5 carboys—one fer each four foot o' screen. We let this set over night and 'till noon. Then we ran th' surge plunger an' poured in some water to work th' acid back in; after that we bailed it out an' got a mess o' mud an' sand. We gave it 5 more carboys th' same way, an' then let it set there over night an' th' next day.

A. T. Feakins of Denville, N. J., used 10 feet of 8-inch Johnson Screen in this well. Yield during 72-hour pumping test was 250 gpm.

An 8-inch Johnson Screen being put in a well for the Wayne Cooperative Milk Producers' Association by Chas. Zuber and Son of Fort Wayne, Indiana. The well pumped 525 g. p. m. with 16 feet drawdown.

In th' meantime th' other wells was pumpin' an' th' engineer was watchin' th' water. After th' second dose had been in about 12 hours, he could see some effect on th' water comin' into the old wells so he shut 'em off. Then we set our airlift again an' went back after it with surgin', blowin' an' pumpin'. What a mess o' dirt an' slime we got along with a lot o' sand. We could see th' well was doin' better, too. When it cleared up, we put in th' test pump an' got 250 g.p.m. with only 12 foot o' drawdown. We was sure a happy bunch. It was a headache but a lot o' fun to lick th' darn thing, too. It was a purty expensive well by th' time we finished all this extra work an' used all that equipment; but it was still a job we was all well satisfied with. They put on a 250 g.p.m. pump an' had all th' water they figgered they'd ever need—an' that's th' last we would probably have done around there except that th' town started to grow. A couple new plants come in that wanted water. So they decided early this year they ought to have another well.

(Continued on Page 10)

(Continued from Page 9)

Well, we was Johnny at th' rat-hole, o' course, an' went right after it. But this time we suggested they go after it a little different. We'd learned somethin' from th' other job. First off, we suggested they should make sure th' sand samples was taken jest like th' stuff laid in th' water vein—without any washing or other change. Then th' screen people could see what they was up against. Second, we suggested that they forget about keepin' their wells close together in one field an' see what they might find with some test wells in other good locations. Th' short of it was that they decided to put in four 6-inch test holes at locations to be agreed on by ev'rybody. Th' first one was to be jest 'bout 200 foot south from their 10-inch well. This was in th' same property that th' city owned. (By the way, I forgot to say that in th' meantime th' two ol' 6-inch wells had rotted out an' gone to pot; so that was another reason fer a new well—so they would have a stand-by fer their 10-inch.)

Th' second test well was to be two blocks away to th' west. It was 'bout 20-foot uphill an' over next to a main water line. Th' third was to be high up (maybe fifty foot higher than th' old well) way over on th' north end o' town—a good half mile from the standpipe but close to where two dead-end mains could be tied in. Th' fourth one was to be on the northeast edge o' town where th' ground sloped down toward a marsh—probably 30 foot below th' ol' well site.

Th' first test well showed up almost exactly like th' original wells. Good water-bearing stuff with a high head but awful dirty an' full o' big messes o' sticky clay. So we just passed right on to the next one.

Th' second test well showed th' followin' log:

Test well No. 2.

Elevation 807'

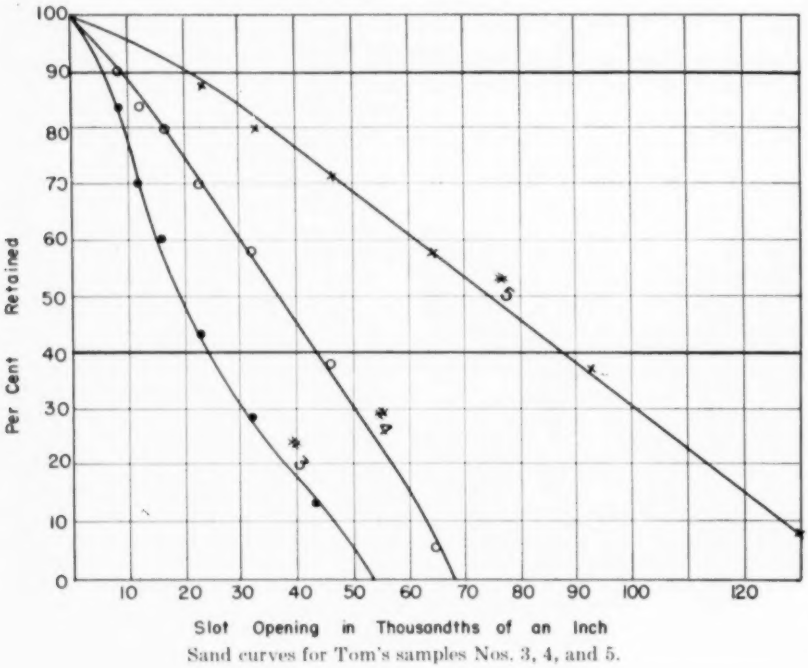
0'	- 6'	Fill material.
6'	- 27'	Sand with some surface water.
27'	- 98'	Mixed sand and clay seams—dry.
98'	- 137'	Blue clay—hard.
137'	- 142'	Sandy clay—little water.
142'	- 168'	Blue clay. Sticky.
168'	- 178'	Clay with sand and gravel. Water level at 25 feet.
178'	- 186'	Dirty mixture of sand, gravel and sticky yellow clay.
186'	- 191'	Finer sand. A little clay.
191'	- 198'	Coarse sand. Some clay.
198'	- 213'	Mixture sand and gravel with some soft clay.
213'	- 222'	Gravel with some boulders and clay.
222'	- 227'	Bouldery material. Stopped drilling at 227'. Water level at 25'.

We took sand samples at 178 - 186, 186 - 191, 191 - 198, 198 - 213 and 213 - 222. We was real careful to take 'em just th' way they come out in th' bailer this time, too.

The first two samples showed plenty o' clay, but numbers 3, 4, and 5 was pretty fair stuff. Number 5 was good and coarse.

Well, this was th' place we decided to make th' new well at. We drilled th' other two test holes but they didn't show no better and they wasn't located so good. Now, as you can see from this dope, this test well showed a doggoned site better stuff than they had down at th' original well location. When th' Johnson people ran th' samples they felt th' stuff was O.K. even if it was purty dirty. They said they figgered it would develop in a normal way without any trouble. Th' screen they recommended was 20 foot long with No. 40 slot at th' top 10 foot, No. 50 slot th' next 3 foot, an' No. 100 slot th' bottom 7 foot. As you can see from th' sand reports, they was being kind of careful about th' dirty stuff on top an' was aiming at doing all they could with th' good coarse stuff at th' bottom. You see, we didn't like that bouldery stuff in th' very bottom so we was plannin' to set th' bottom o' th' screen at 222 foot which would bring th' top opening at about 202 foot in th' stuff we got in our sample No. 4 an' passin' up th' stuff above this.

I guess I didn't say—but th' final well was a 12-inch well. We went ahead an' set th' screen, pulled back, swedged out and bailed real hard. We could see right away it was behaving O.K. We got a fairly good development jest with th' bailer. Then when we took th' surge plunger we started easy, cleaned out, and went along kind o' careful—gettin' a little stronger as she came along. We spent only a little over a day until she seemed ready fer th' test pump. When we turned her loose an' had 500 g.p.m. comin' out, th' drawdown was holdin' at 11 foot. It was clean as a hound's tooth after a couple hours of pumpin' an' we got our O.K. after 6 hours—with th' drawdown still holdin' inside of 12 foot.



Sand curves for Tom's samples Nos. 3, 4, and 5.

Now, I think there's a couple points that are worth mentionin' here at th' end o' this little story. First off, unless th' geology is purty sure at a place like this, it usually pays to run test wells—not little stinkers but big enough to know what you're gettin'.

Another thing—I don't think th' acid did much more than break down th' fat clay that was pulled in purty close to th' screen. I've heard o' some other cases like this where they've tried acid an' it seems like it has done some good in some o' them an' no good in others. Probably depends on th' clay an' jest how it is mixed in th' vein. A driller wouldn't want to try this except as a last resort an' then he has to know his ropes or he'll jest be wasting time an' money. I always say, though, that a good well driller who has been through th' mill can usually figger out a way to lick a tough well job. I take my hat off to these boys. They don't give up easy. When I look at them, I get prouder of th' profession. It's come a long ways th' last 50 years, ain't it?

Yer ol' friend
TOM

REASONS WHY SOME WELLS ARE DISAPPOINTMENTS

(Continued from Page 4)

do the development work, leaving the rotary free to move to another job. Before leaving, however, the rotary was used to put down an observation well about 107 feet from the main well as the owner had decided to make a careful pumping test of the permanent well upon completion.

The 12-inch well was thoroughly developed using both compressed air and a surge block. A test pump was set in and operated for a couple of hours preparatory to making the controlled pumping test. This preliminary pumping showed a specific capacity of 65 gpm per foot of drawdown. Obviously, the well was an excellent one. At this specific capacity, the well would have produced 2000 gpm at 31 feet drawdown, if the aquifer were large enough to support such a rate of pumpage. Any farmer would be glad to have a well like that.

(To be continued in July-August issue)

GROUND WATER RESOURCES— LARGE CITIES AND INDUSTRIAL AREAS

From U. S. Geological Survey Reports

Many people interested in the water well and water supply industry do not realize that the U. S. Geological Survey periodically publishes reports on the water supply resources of various areas. These reports set out briefly the actual facts regarding the availability, quality, and often quantity of water resources in the areas covered by the studies.

Recently a number of these reports were sent to us by C. G. Paulsen, Chief Hydraulic Engineer, U. S. G. S. One of much interest covered Southeastern Bucks County, Pennsylvania. This is the area near Morrisville, Pennsylvania, in which the U. S. Steel Corporation's new plant has been constructed at a cost of $300,000,000. Many additional industries have located in this area and thousands of new homes have been constructed for the workers and their families.

While the Delaware River is the principal source of water supply, large quantities of ground water have been developed and are being used in connection with this project. The present use of ground water is only a small fraction of the potential supply, as large undeveloped supplies are present beneath the alluvial plain of the Delaware River and additional supplies of large capacity can be developed from wells located along the Delaware River so as to induce infiltration from the river. Chemically, the ground water is satisfactory, except for excessive iron and intrate contents in some localities. The water is relatively constant in temperature and is cool in summer, making it suitable for use in cooling.

The report on the water resources of Atlanta, Georgia supplied the answers to many questions that had been raised by the people and industry regarding their water supply. The total use in the Metropolitan Area amounted to 519,000,000 gallons of surface water per day and 17,400,000 gallons of ground water. This was an increase of 50% from 1940 to 1950.

The interesting thing in the report is the statement that contrary to popular belief, the water table does not become lower each year, except in local areas of heavy pumping. Both dug wells and drilled wells are used, depending on the capacity wanted and location. Eight to twelve-inch drilled wells yield up to 400 g.p.m. with water temperatures in most wells 60° to 62° Fahr. Such water is ideal for air conditioning.

The report for the Detroit, Michigan area states that the potential supply is almost unlimited. In 1950 Detroit used 2,949,000,000 gallons of water per day from Lake St. Clair and the Detroit River and 43,000,000 gallons of ground water or about 15% of the total. Large additional supplies of ground water can be developed from the glacial deposits in the area but accurate test drilling will be rquired to locate the deposits as they are widely distributed and spotty. The ground water supplies vary widely in mineral constituents, but have an average temperature of about 52° Fahr. The most favorable areas for more ground water are in the alluvial filled valley of the Huron River. Some yields as high as 4,000 g.p.m. have been obtained in this area where conditions were favorable for induced infiltration.

(To be continued in next issue)

V. J. Harley & Son, Junction City, Ohio, pulling 6-inch casing to expose 10-ft. Johnson Everdur Screen in water-bearing sand in well of Diamond Power Specialty Corporation.

ASSOCIATION NEWS

This section is devoted to the exclusive use of water well drillers' associations, both state and local. Notices, announcements, changes of officers and other items should be sent to The Editor, Johnson National Drillers' Journal, 2304 Long Ave., St. Paul 14, Minnesota.

OREGON

At the last annual meeting of the Oregon Drilling Association, a new program that should be of real interest and benefit to the drilling industry as a whole was initiated.

The Association is in the process of presenting to its membership a health and accident insurance program that represents a distinct saving in insurance costs. This is particularly attractive to the owner-operators who do not come under the workmen's compensation laws of the state.

Another committee is looking into a public relations program, to build the Association membership up to the maximum. The long-range goal is to improve public acceptance of the industry and to promote closer cooperation with the legislature on laws affecting conservation, sanitation, and licensing.

A regional meeting was held at Eugene, Oregon, March 21, 1953. Local chapters are being organized throughout the state. These are to meet every two months. It is felt that these regional meetings are the "life blood" of the state organization.

New officers elected to serve for 1953 are as follows: C. E. Miller, president, Eugene; Harry Robinson, vice-president, and E. O. Jannsen, secretary-treasurer.

—o—

WASHINGTON

The Spring regional meeting of the Washington State Well Drillers Association was held at the Benjamin Franklin Hotel in Seattle, March 21, 1953. There was a large turnout, two excellent speakers, and a full and interesting program.

There is interest in some form of group insurance such as the Oregon Association is working on, and investigation of the matter is under way.

O. E. Erdman resigned as secretary-treasurer, due to the fact that he will be in Peru for some time directing a drilling project. George Zent of Vancouver was appointed to fill this position until the annual election in November.

—o—

COLORADO

Both members and non-members of the Colorado Water Well Contractors are urged to attend the first mid-year meeting of the Association to be held in the Elks Hall at Alamosa, Colorado on Saturday, June 6, beginning at 10 a.m. Many questions of interest will be discussed, and a banquet and entertainment is scheduled for the evening.

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OKLAHOMA

The Oklahoma Water Well Drillers Association held its Fourth Annual Convention at the Extension Study Center, University of Oklahoma, Norman, on October 30 and 31, 1952. The principal items of business were the adoption by Association of the Revised Specifications for Public Water Supply Wells, and the election of new directors and officers.

The directors elected were V. C. Mickle, I. V. Owen, and Earl Kelley. The directors chose R. D. Sawyer as president and Marvin Baker as vice-president for the coming year. George Reid, Professor of Sanitary Engineering at the University, was chosen secretary-treasurer to succeed L. J. Clarke.

KANSAS

The last meeting of the Kansas Water Well Drillers Association was the annual meeting held in Lawrence in December. The officers and directors held a meeting in Salina on April 26, and steps were taken to plan the next annual meeting. The Association will probably hold a picnic in late summer.

The new officers are as follows: Hazen Bledsoe, president, Strong City; Lon Dietrich, vice-president, Ottawa; J. G. Lassey, secretary-treasurer, Miltonvale; and J. M. Jewett, service secretary, 111 Lindley Hall, Lawrence.

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MONTANA

The Montana Water Well Drillers Association held its annual convention at Bozeman, Montana at the Baxter Hotel, March 9 and 10, 1953.

There was a good turnout of interested drillers, and the program was furnished by Mr. Brinck of the Montana State Board of Health; Mr. Wolfe of Great Northern Tool & Supply, Billings; Mr. Swenson of the U. S. Geological Survey, Billings; and Mrs. Cayser of Livingston.

A tour of Montana State College was arranged for the wives of the drillers. The banquet program included an excellent male quartet, slides of Mr. Swenson's trip to

Developing a 12-inch well with air and surge plunger combined by Andriot-Davidson Company of Louisville, Kentucky, for Ebasco Services, Inc. and Green River Steel Corporation. Well equipped with 25-ft. Johnson screen Test-pumped 24 hours at 800 gpm with 20-ft. drawdown, and two hours at 1200 gpm with 30-ft. drawdown.

Arthur J. Stewart of Phoenix. It's really dry in Arizona but he can get ground water with his Bucyrus-Erie 22-W.

study water resources in India, and a string ensemble.

The new slate of officers elected is as follows: K. D. Thompson, president, Wibaux; Carl Hollensteiner, vice-president, Dillon; and Bert Van Dyken, secretary, Bozeman.

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IDAHO

The Idaho State Drillers Association will hold its annual convention at Sun Valley, Idaho, the 10th and 11th of July. Further details of the meeting can be obtained from W. B. Bowler, secretary, 400 McCarty Bldg., Boise.

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ONTARIO

The annual convention of the Ontario Water Well Association will be held at the Prince George Hotel, Toronto, Ontario on June 5, 1953. Registration will be in the Floral Room during the morning. The meeting will be held in the Floral Room during the afternoon, and a banquet during the evening will be followed by a program of entertainment. The banquet and entertainment will be open to members' wives and guests.

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PENNSYLVANIA

The Eastern Section of the Pennsylvania Water Well Contractor's Association has announced officers for the year 1953-1954. They are as follows:

Edward D. Potter, executive president, North Wales; Frank Parente, president, Norristown; Leon Slauch, first vice-president, Oxford; Edward D. Potter, second vice-president, North Wales; Charles Lauman, third vice-president, Norristown; W. Rollin Raab, secretary, Churchville; O. B. Gill, treasurer, Lebanon.

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SOUTH DAKOTA

The South Dakota Well Drillers Association met at the Marvin Hughitt Hotel, Huron, S. D., on March 27 and 28. Nearly 50 operators were present, including seven new members who joined the association in 1953. Every section of the state was represented.

There were a number of topics discussed at the two-day meeting, among which were South Dakota geology and water supply, business problems of the smaller contractor, agricultural economics as they pertain to the future of the well drilling industry in South Dakota, and water wells for irrigation of crop lands.

A luncheon for members' wives was given by the Association, and a large banquet and entertainment, followed by dancing, highlighted the evening. All agreed that it was one of the more successful meetings. Next year's meeting of the Association will be held at Pierre on the first weekend in March.

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INDIANA

A very successful 22nd convention was held by the Indiana Well Drilling Contractors' Association at Indianapolis on May 7 and 8. Exhibits and meetings were held at the State Fair Grounds in the Agricultural Building. The annual banquet was at the Antlers Hotel.

There was a good attendance of drillers from almost all sections of the state. Exhibits were set up by some 25 manufacturers and jobbers.

At the banquet, O. A. Billman of Ligonier and Grover Stremmel of LaFontaine were honored by being granted life memberships in the Association. This way of honoring long-time, faithful members has been adopted as a custom by this group. Frank Wallace, State Entomologist, gave an excellent illustrated talk on the natural beauties of numerous Indiana state parks.

The officers elected for the coming year were R. T. Hill, president, LaFontaine; Pete Bojrab, vice-president, Fort Wayne; H. K. Carr, secretary, Greentown; Melvin Hahn, treasurer, Nappanee. Herb Lamb was elected to a three-year term as director. The ladies auxiliary held its own meetings. Its officers for the new year are Mrs. C. E. Snellenberger, president, South Bend; Mrs. H. W. Lander, vice-president, Marion; and Mrs. James Payne, secretary-treasurer, Plymouth.

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MICHIGAN

The Silver Anniversary convention of the Michigan Well Drillers Association at Jackson, Michigan, on May 26, 27, and 28 was an outstanding event. A detailed report on the program, business meeting, and exhibits will appear in the next issue of the Journal as the meeting was held just as this issue was going to press.

Cia. de Perforacoes Comerciais of Rio de Janeiro setting 8-inch casing in a well near Sao Paulo, Brazil. This is a Brazilian enterprise of Mr. J. L. Harper of Cleveland, Ohio.

MISSOURI

The 17th annual convention of the Missouri Water Well Drillers Association was held April 13 and 14 at the Colonial Hotel, Springfield, Missouri. Attendance was larger this year than it was the two preceding years. There were 59 members registered (drillers), 38 associate members (manufacturers representatives, etc.), and a number of guests.

New officers elected were Charles Wise, president, Kirkwood; Frank Weldon, vice-president, Cape Girardeau; D. T. Carroll, secretary, Swedeborg; and W. B. Russell, treasurer, Bolivar. Dale L. Fuller, of Rolla, remains service secretary.

Rufus Claus of Palmyra, Missouri, and his Cyclone rig drilling a well for a large livestock farm near La Grange, Missouri.

ADVERTISEMENTS

We will insert advertisements for drilling equipment wanted or for sale, help or work wanted, etc., for our readers, free of charge. Advertisements must be brief, and we cannot assume responsibility for them, but will be glad to put parties in touch with each other by this means and suggest that they investigate any offers or inquiries carefully for themselves.

FOR SALE: No. 240 Speed Star spudder, two years old, good condition and operating every day. Mounted on K-5 International 1½-ton truck. Truck in first-clas condition, good tires, go anywhere. Price $2850.00. No tools. Write: George I. Warner, P. O. Box 104, McBean, Georgia.

FOR SALE: Pump business, also well drilling rig and shop tools. If interested, contact: S. J. Davis, 1009 West Fir, Portales, New Mexico.

FOR SALE: Bucyrus-Erie 21-W rig equipped with 6-inch tools and lines; mounted on a 1½-ton Dodge truck. Write: Edward Sanders, 226 Nelson Avenue, Saratoga Springs, New York.

WANTED: Used 1000-foot rotary Mayhew or Franks truck mounted drill rig; also mud pump, Gardner-Denver, or Wheatly 5x6 or 4x5. Write: E. R. Hanson & Sons, Wahoo, Nebraska.

FOR SALE: Two all steel drilling rigs, mounted on truck; pipe 2", 5", 6" galvanized 6⅝" black; two 10 foot 10-inch well screens No. 60 slot, also drilling tools. Write: Clarence Chadwick, Box 14, Deford, Michigan.

FOR SALE: One 5"rotary table, one 2½" bushing for 5" table, one 15XV King swivel, this equipment is brand new, will sell same for one-half price or $503.00. Write: D. E. Edwards, Inc., West Branch, Iowa.

FOR SALE: Drill tools complete string of 3" tools for 4" work; 6" bailer, fishing tools, rope sockets. Write: George Hutchinson, R. 2, Wadsworth, Ohio.

FOR SALE: 1951, 22W drilling machine, with tools and cable; mounted on 1½ ton White truck. Price $7,500.00. Write: L. J. Kessler, Troy, Missouri, phone 349J.

FOR SALE: Rotary drilling rig, in good condition, price $2,500.00. Write: Watts & Vestal Drilling Company, Farwell, Texas.

FOR SALE: One Deming figure 4700 deep-well turbine pump, serial No. 14417, consisting of the following: One 8" 7-stage bowl assembly; ten 10-foot sections of 6" x 1¼" sleeve-coupled column; one 5" strainer; one SD88 - 16½ disch. head fitted with Johnson HP 30, 1:1 ratio gear head; one 36" flexible shaft with flanges. Capacity 500 g.p.m. at 125' TDH: One Ford industrial power unit, Model #120, complete with safety shutdown device. Good as new, purchased last year, operated about ten hours. Immediate delivery, $2,500.00, f.o.b., Cranbury, New Jersey. Write: Lewis W. Barton Company, Kresson Road, Haddonfield, New Jersey. Phone: Haddonfield 9-6500.

An 8-inch Johnson Everdur Screen, 7 feet long, being installed by William C. Selmer of Madison, Wis., in a well for H. M. Zander Creamery Co. Total depth 49 feet, yield 115 gpm at 4⅔ feet drawdown.

FOR SALE: One 33W Bucyrus-Erie, mounted on a 1½ ton Chevrolet truck; this machine is completely re-conditioned, has new four cylinder LeRoi motor. This drill is in excellent condition will sell with or without drilling tools and cable. Write: D. E. Edwards, Inc., West Branch, Iowa.

FOR SALE: Drilling business. Howell jetting drilling rig mounted on 1940 3-ton International K-5 truck in good working order, with 400 ft. 2-inch drill rods; 400 ft. 1-inch rods, lots of tools. Work to start on; all modern 6-room house with a little over one acre of ground; good territory to work in. Write: A. F. Boettcher, Fonda, Iowa.

C. W. Rouse & Sons of Clarence, Iowa, took 26 hours to drill through 18 feet of overburden to rock and 4 hours for 20 feet of rock hole on this job. Static level was 36 feet and well yield was 20 gpm.

FOR SALE: Well drilling rig used for prospecting; recently rebuilt throughout of White Oak timbers, steel cable rigging, complete with new string of 2¼-3¼" tools. International power unit, trailer mounted; drill used one year after over-hauling; $1200.00 with prospecting accessories; World War II Veteran finishing college. Write: A. D. Williams, 206 S. Chestnut St., Platteville, Wisconsin.

FOR SALE: Rebuilt Keystone rig, located Washington County, Oklahoma; trailer mounted, truck and tools; 700-ft. capacity; Hercules engine, $1800.00; working on well. Write: Box Mil, c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 14, Minnesota.

FOR SALE: Two all steel drilling rigs, 22-W Bucyrus Erie mounted on good International truck, 36-foot derrick, 35 h.p. Hercules engine, electric starter, calf reel; level wind 500 ft. ⅝ in. drilling cable; 50 ft. ⅜ in. sand line. No tools; price $5000.00; also Ideco No. 16 mounted on 1947 Chevrolet truck, extra good; 36-foot telescope derrick rubber shock in head, 36 h.p. red seal Continental motor; electric starters in front and rear of rig; electric hoist to raise and lower derrick; calf reel; 500 ft. ⅝ in. drilling cable; 500 ft. ⅜ in. sand line; double crank on walking beam; rigs are in A-1 shape, ready to go to work. No tools. Write: Guy Beemer, Lakota, Iowa.

FOR SALE: Sullivan No. 37 drill mounted on 1941 Ford 1½-ton truck, Gardner-Denver 4x5 duplex mud pump; completely equipped, ready to drill, with 100 feet of N rods; drill complete overhauled; truck has new exchange motor. For quick sale $4500.00 cash F.O.B. my shop. Write: J. L. Havlick, 2703 N. Pittsburg Street, Spokane, Washington.

FOR SALE: I.C.K. Model Waukesha Engine with twin disk clutch 13 H.P. at 1300 RPM. Has done 4-inch and 6-inch work. Overhauled recently. Starts good. Price $150.00. Write: E. E. Cribley and Son, 7105 Dexter-Ann Arbor Road, Dexter, Michigan.

WANTED: Cable tool drilling machine for 4" and smaller wells, mounted or unmounted, in good shape, reasonably priced. Borman Plumbing & Heating, 9737 Lyndale Ave., So., Minneapolis, Minn.

FOR SALE: Cyclone 35 hollow-rod drilling machine, mounted on Chevrolet truck; also Cyclone 42 all-steel machine, mounted on truck. Clarence Obermiller, Creston, Ohio.

FOR SALE: Bucyrus-Erie 22-W drilling machine, 1948 model, mounted on 2-3 ton D-40 International truck. Equipped with casing reel, spooling device, blower, drilling cables, and tools 2¼x3¼-7 joint. Drill and truck in good condition. Will sell with or without tools or cable. Kessler Well Co., Troy, Mo.

FOR SALE: Keystone 70 drilling machine on Reo truck. Now operating. 1000-ft. 5/8" cable and 3/8" sand line; 4", 6", 8" bits; one set 4 1/2" jars; two bailers, 3" and 4"; two driving clamps; two sets wrenches; two chain wrenches; two drill stems, 3"x20' and 4 1/4"x16'. Price $2200 f. o. b. my shop. Abner L. Thompson, Route 1, Box 225, Maitland, Fla. Phone W. P. 272812.

WANTED: Bucyrus-Erie 20-W, 22-W or comparable drilling machine. Give full particulars regarding tools, price, etc. Bernard Schultz, Parshall, N. Dak.

WANTED: Combination socket, swivel wire-rope socket, fishing jars, and a short stem for 4" work. Prefer 1 1/2x2 1/4-8 API joints. Robert T. Wilton, Trevor, Wis.

FOR SALE: Franks Model F rotary drill, 1000-ft. capacity, on Ford truck with new motors. Hydraulic pull-down, 4x5 Gardner-Denver mud pump, 150-ft. 2 3/8" OD drill pipe. Truck has good tires, 2-speed axle and winch. Price $5000. Donald J. Roe, Box 211, Vandalia, Ohio. Phone 4-4514.

FOR SALE: Sullivan No. 37 drill mounted on 1941 Ford 1 1/2-ton truck. Gardner-Denver 4x5 duplex mud pump. Overhauled, completely equipped, ready to drill. Truck has new exchange motor. Price $4000 cash, f. o. b. my shop. J. L. Havlock, 2703 N. Pittsburg St., Spokane, Wash.

WANTED: Underreamer to run in 6" pipe. State condition, make and price. Herschel Mourning, Box 229, Colchester, Ill.

FOR SALE: About 15,000 ft. 8" ID, 28-lb. used line pipe; about 2000 feet 6" ID, 19-lb. used line pipe; about 23,000 feet 6" OD, 10 1/2-lb. used casing. Excellent condition. D. S. Dempsey & Son, Bolivar, N. Y.

FOR SALE: Chapman well drilling machine, 7 h. p. engine, tractor-trailer with good tires. String of 3 1/4" tools with new API joints; 500-ft. 3/4" and 3/8" sand line. All in A-1 condition. P. Jacobson, Indian Grove, Port Credit, Ont., Canada.

WANTED: No. 71 Speed Star drill in good condition, with tools for drilling 16" wells, 100 feet deep. Write: Box RP, c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 14, Minnesota.

WANTED: Competent drillers. Steady work. Write: Artesian Well and Equipment Company, Inc., Rochelle Park, New Jersey.

Lushbun arrived home at 3:30 a.m. He tried to get in quietly but as he pushed open the door, the lights went on and he saw his wife standing at the head of the stairs.

"Well," she sneered, "so home is the best place after all."

"Tisn't so," answered Lushbun thickly. "Right now, it's the only place open."

Drilling machine of McFarlane and Partridge, Craik, Saskatchewan. Test pumping a completed farm well in northern Saskatchewan.

An old lady was walking along the creek one fine summer day, and came upon several boys bathing in their birthday suits.

"Boys," she exclaimed, "isn't it against the law to go swimming without a bathing suit?"

"Yessum," replied one of the youngsters, "But come on in and we won't tell on you."

—o—

American Tourist (in Shakespeare's country): "But say — Shakespeare seems to have slept in all the cottages around here."

Cottager: "Ah, zur — there worn't a more sociable young chap in the neighborhood!"

—o—

"How's your car running?"

"Not so good. I can't keep it throttled down."

"How's your wife?"

"Oh, she's about the same."

FOR YOUR CONVENIENCE, Edward E. Johnson, Inc. has printed a code book for ordering Johnson Well Screens by telegram. This allows almost any screen to be ordered in a minimum-rate telegram. This useful and convenient booklet will be sent to you on request.

DRILLING-TOOL JOINTS

(Continued from Page 7)

The Institute gives a splendid set of rules for the care and use of working gages. Since the joints of a driller's tools are in a sense "working gages" the same rules for their care might well be applied. The following is the recommended practice:

1. Gages are a valuable asset. It is assumed that they are accurate. If not, they lose their value as gages. Being accurate they represent some considerable investment and for this reason they should be given proper care. A gage cannot be abused and still retain its accuracy. Neither can a gage be allowed to deteriorate and still function properly. To conserve the value represented they must be properly handled.
2. Gages should be kept free from dirt and grit. It is important that they be kept clean. Provide a suitable place for storage. When gages are stored away it is advisable that they be kept separate and not made up in pairs. Coat with a good grade of slushing oil when not in use. Examine the gages for burrs on threads which may have been caused by rough handling. Remove any burrs by stoning with a medium fine stone or with a fine file.
3. Handle gages with care. Clean both gage and product thoroughly before assembling. A light film of thin oil will protect the gage when in use and increase its life. Accurate surfaces when set up dry under pressure have a tendency to seize and pick up metal. A light oil film will eliminate this. Gages should be set up firmly in the product. Loose gaging produces loose joints.

Reference

Portions of this article and the illustrations are from API Standard 3, "Specification for Cable Drilling Tools" and are used by permission of the American Petroleum Institute, Dallas, Texas.

(This article will be concluded in the next issue of the Journal with a summary of the API specifications for Rotary Drilling Equipment.)

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***Strength and Durability* — all-welded construction of corrosion-resistant metals for any water.**

***Perfect Development* — slot design permits a perfect job of developing the well to its maximum capacity.**

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